"APPROVED FOR RELEASE: 04/03/2001 CIA-RDP86-00513R001757210007-1

SOV/56-34-6-30/51 A Contribution to the Phenomenological Theory of Kinetic Processes in Ferromagnetic Dielectrics. I. The Pelaxation in the Gas of the Spin Waves

> Akhiyezer, L. D. Landau and I. M. Lifshits for useful advice and also V. G. Bar'yakhtar and S. V. Peletminskiy for profitable discussions. There are 9 references, 6 of which are Soviet.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR

(Physics and Technical Institute, AS UkrSSR)

March 22, 1958 SUBMITTED:

Card 3/3

"APPROVED FOR RELEASE: 04/03/2001 CIA-RDP86-00513R001757210007-1

30V/56-35-2-25/60 24(6) Kaganov, M. I., Tsukernik, V. M. AUTHORS: The Influence of Thermoelectric Forces on the Skin Effect in Metal (Vliyaniye termoelektricheskikh sil na skin-effekt v TITLE: metalle) Zhornal eksperimental noy i teoreticheskoy fiziki, 1958, PERIODICAL: Vol 35, Nr 2, pp 474-478 (USSR) Formulae are deduced for the surface resistance in consideration of thermoelectric forces. The following system of equa-ABSTRACT: curl $\vec{H} = \frac{4}{c} \vec{j}$; curl $\vec{k} = -\frac{1}{c} \frac{d\vec{H}}{dt}$; $c \frac{\partial \theta}{\partial t} + div \vec{q} = 0$; $\vec{E}_i = \theta_{ik} \vec{J}_k + \alpha_{ik} \frac{\partial \theta}{\partial x_k} \vec{a}_i = T\alpha_k \vec{J}_k - \kappa_{ik} \frac{\partial \theta}{\partial x_k} \vec{a}_k$ tions serves as a basis: where Θ is the high-frequency addition to the average temperature T of the sample, C - the specific heat of the metal, q the heat nurrent, Xik-the resistance tensor, Qik- the thermal conductivity tensor, and α_{ik}^{-} the tensor of the thermoelectrical coefficients. $(\alpha_{ik} = \alpha_{ki})$. Card 1/2

SOV/86-38-2-23/60

The Influence of Thermoelectric Forces on the Skin Effect in Metal

For the surface impedance it holds that $\int_{\mathbf{x}} \mathbf{x} = \mathbf{E}_{\mathbf{x}}(0)/\mathbf{H}_{\mathbf{y}}(0)$ and $\int_{\mathbf{y}} \mathbf{x} = \mathbf{E}_{\mathbf{y}}(0)/\mathbf{H}_{\mathbf{x}}(0)$; $\int_{\mathbf{x}} \mathbf{x} = \int_{\mathbf{G}\mathbf{x}} \sqrt{\omega_{0}} \sqrt{4\pi i} = \sqrt{\omega_{0}}/4\pi i$; $(o_{\perp} = o_{22} = o_{33}; o_{11} = o_{11})$ and $\int_{\mathbf{y}}$ is decomposed into $\int_{\mathbf{y}}^{\mathbf{ad}}$ and $\begin{cases} v \end{cases}$, for which equations are deduced as well. In the case of isotropy $\xi = 1/|\xi - \sin^2 \varphi|$ and $\xi^{\rm isoth} - |\xi - \sin^2 \varphi| / \xi$ is obtained, and for $\xi^{\rm ad}$ a considerably more complicated expression is found, the first term of which is equal to the expression for \$\xi^{\text{isoth}}\$. In conclusion, the authors express their gratitude to L. D. Landau for his valuable discussions. There are 2 references, 2 of which are Soviet.

AGSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk USSR (Phys) co-Technical Institute, AS UkrSSR)

SUBMITTED:

March 26, 1958

Card 2/2

SOW/30-59-2-42/60 sical and Mathematical Sciences	physics (Issledovaniya po	Er 2, 39 98-100 (152	this proples cook places in the straight of the properties of the properties of the properties of the straight of the properties of the straight of the straig	Anness Statistics of the control of	the theore of which was discovered in the theory of which as one will provide and his colling the coll	reported on kinetic pleaneess iters. Lessoy and a state of the state	ak the and of the Conference stul development of the series reture physics. The partici- reture of the Acquery of Science bysics facility of Thills gof the new fearests aftering
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24(0) AUTHOR:	11111	PERIODICAL:	ABSTIACT:	Card 1/4	Gast. 2/4.	:	

"APPROVED FOR RELEASE: 04/03/2001 CIA-RDP86-00513R001757210007-1

SOV/56-36-1-30/62 24(3) Kaganov, M. I., Tsukernik, V. M. AUTHORS: On the Phenomenological Theory of the Kinetic Processes in Ferromagnetic Dielectrics (K fenomenologicheskoy teorii TITLE: kineticheskikh protsessov v ferromagnitnykh dielektrikakh) II. The Interaction of Spin Waves With Phonons (II. Vzaimodeystviye spinovykh voln s fononami) Zhurnal eksperimental noyitsoreticheskoy fiziki, 1959, PERIODICAL: Vol 36, Nr 1, pp 224-232 (USSR) The spin waves have to be described by the vector of the density of the magnetic moment $\overline{M} = \overline{M}(\overline{r}, t)$ by the deformation tensor $u_{ik} = (1/2) (\partial u_i/\partial x_k + \partial u_k/\partial x_i)$ where $u = u(\overline{r}, t)$ ABSTRACT: denotes the vector of displacement. In this case, the interaction Hamiltonian will be the sum of all components in the expansion of the energy of the ferromagnetic with respect to the powers of M_i, ∂ M_i/ $\bar{\partial}$ x_k, and u_{ik}: γ _{iklm} \int M_iM_ku_{lm} dv, $\lambda_{iklmrs} = \int_{\overline{\partial x_k}}^{\underline{\partial M_i}} \frac{\partial M_1}{\partial x_m} u_{rs} dv$. The first of these terms corresponds to the energy of magnetostriction. The interaction Hamiltonian Card 1/3

507/56-36-1-30/62 On the Phenomenological Theory of the Kinetic Processes in Ferromagnetic Dielectrics. II. The Interaction of Spin Waves With Phonons

is written down as $H_{\text{interaction}} = H_{\text{magnetostriction}} \stackrel{\text{H}}{=} \text{exchange}$, where $H_{\text{interaction}} = \mathcal{J} / M_{i} M_{k} u_{ik} dv$, $H_{\text{exchange}} = \lambda_{1} / \frac{\partial M_{1}}{\partial x_{i}} \frac{\partial M_{1}}{\partial x_{k}} u_{ik} dv + \lambda_{2} / \frac{\partial M_{1}}{\partial x_{i}} \frac{\partial M_{1}}{\partial x_{i}} u_{kk} dv.$

In the second part of the paper the production and the absorption of phonons by spin waves are calculated. The authors also investigate the energy transfer from spin waves to phonons. The spin waves and the phonons are described by equilibrium distribution functions of the Bose (Boze) type for different temperatures. The coefficient of heat transfer for the activation process of the emission and absorption of phonons decreases exponentially with temperature. The third part of the present paper deals with the annihilation of 2 spin waves with production of a phonon and with the decay of a phonon into 2 spin waves. These processes are due to the magnetostriction part of the Hamiltonian. Practically at any temperature above who, production and absorption of phonons

Card 2/3

On the Phenomenological Theory of the Kinetic Processes in Ferromagnetic Dielectrics. II. The Interaction SOV/56-36-1-30/62

> play the most important part among the one-phonon processes. The two-photon processes are described by the square terms of the expansion of the energy of the ferromagnetic with respect to the powers of the deformation tensor. There are 2 types of such processes: scattering of a phonon on a spin wave (or vice versa) and emission (or absorption) of 2 phonons by a spin wave. Finally, the time necessary for the establishment of equilibrium (relaxation time) between spin waves and phonons is calculated. There are 5 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physico-Technical Institute of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED:

July 8, 1958

Card 3/3

24 (3) AUTHORS:

Kaganov, M. I., Tsukernik, V. M.

SOV/56-37-3-35/62

TITLE:

Nonresonance Absorption of the Energy of a Variable Magnetic

Field by a Ferromagnetic Dielectrics

PERIODICAL:

Zhurnal eksperimental noy i teoreticheskoy fiziki, 1959,

Vol 37, Nr 3 (9), pp 823-832 (USSR)

ABSTRACT:

A ferromagnetic substance may absorb the energy of a variable magnetic field in various ways: either the magnetic field (the

amplitude of which is to be small, H' $\sim e^{-i\omega t}$) is polarized perpendicular to the equilibrium magnetic moment, in which case the magnetic field turns the moment without changing its value, or the field is polarized in the direction of the moment, in which case a superposed magnetization occurs, i.e. the absolute value of the magnetic moment is varied. In both cases dissipative processes are caused, which are interrelated with the interaction of spin waves, both among themselves, and also with phonons (it is assumed that the dielectric substance is magnetized up to saturation). In the present paper the authors

confine their attention to those in which the variable magnetic

field (frequency ω) is polarized in the direction of the

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Nonresonance Absorption of the Energy of a Variable Magnetic Field by a Ferromagnetic Dielectrics

507/56-37-3-35/62

equilibrium moment. Calculation of absorption is then reduced to calculation of the imaginary part of longitudinal magnetic susceptibility $\mu_{ii} = \mu_{ii}^{i} + i\mu_{ii}^{ii}$. The complex character of the relaxation processes in ferromagnetic dielectrics leads to a complex frequency dependence $\mu_{ii}^{ii}(\omega)$. The authors proceed from the simple model, in which the ferrodielectric body is considered to have a magnetic moment, the vibrations of which propagate in form of spin waves. This is justified at sufficiently low temperatures, when the vibrations of one of the magnetic sublattices are not excited by the others. The theory of spin waves may be applied to real bodies, e.g. to ferrites the semiconductor properties of which at low temperatures are insignificant (the number of free electrons with decreasing temperature tends exponentially towards zero). The first part of this paper deals with the low frequency range, i.e. ω is much smaller than the reciprocal spin-spin relaxation time au_{ss} : $\omega au_{ss} \ll 1$. The following is obtained for the imaginary part of the longitudinal magnetic susceptibility after all frequencyand temperature ranges have been dealt with in detail:

Card 2/4

Monresonance Absorption of the Energy of a Variable Semagnetic Field by a Ferromagnetic Dielectrics

$$\mu'' \sim \begin{cases} \frac{M_o \mu}{\theta_c} \left(\frac{T}{\theta_c}\right)^{1/2} \frac{\omega \tau_{s1}}{1 + \omega^2 \tau_{s1}^2} , & \omega \sqrt{\tau_{s1} \tau_{ss}} \ll 1 , & T \ll T_o \\ \frac{\mu M_o}{\theta_c} \left(\frac{T}{\theta_c}\right)^{1/2} \frac{\omega \tau_{ss}}{1 + \omega^2 \tau_{ss}^2} , & \omega \sqrt{\tau_{s1} \tau_{ss}} \gg 1 , & T \ll T_o \\ \frac{R_o \mu}{\mu M_o} \frac{1 + \omega^2 \tau_{ss}^2}{(1 + \omega^2 \tau_1^2)^2 + \omega^2 \tau_3^2} , & \omega \tau_{ss} \ll 1 , & T \gg T_o \end{cases}$$

Here $T_o \sim \mu M_o (\theta_c/\mu M_o)^{3/7}$, τ_{sl} denotes the spin-lattice relaxation time. The second part deals with high frequencies $(\omega \gg 1/\tau_{ss})$, the Hemiltonian of the interaction between field and spir being set up according to Kaganov (Ref 2): $\mathcal{H}_{int} = \mu \int \hat{H}_z \hat{a}^*(\vec{r}) \hat{a}(\vec{r}) dv. \text{ If } \omega \text{ tends towards } \infty, \text{ then magnetic susceptibility tends towards unity, and its imaginary part towards zero. For the frequency dependence of <math>\mu$ " at very high

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Monresonance Absorption of the Energy of a Variable Magnetic Field by a Ferromagnetic Dielectrics

SOV/56-37-3-35/62

frequencies it holds that $\mu'' \approx \frac{8\sqrt{2} \cdot \mu^2}{15} \frac{(2\pi \mu M_0)^2}{a^3} \frac{(2\pi \mu M_0)^2}{\theta_c^{3/2} (\Re \omega)^{3/2}}$,

 $(\hbar\omega\gg \frac{1}{\tau_{_{\rm BS}}}$, T , $\mu_{{\rm H}_{_{\rm eff}}}$. Thus, μ'' decreases inversely

proportionally with $\omega^{3/2}$ and is independent of temperature. The authors thank V. G. Earlyakhtar for valuable discussions.

There are 10 Soviet references.

Fiziko-tekhricheskiy institut Akademii nauk Ukrainskoy SSR ASSOCIATION:

(Physico-technical Institute of the Academy of Sciences.

Ukrainskaya SSR)

SUBMITTED:

April 18, 1959

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24.2200 (1385,1144,1162)

Kaganov, M.I., Tsukernik, V.M. and Chupis, I.Ye. Theory of Relaxation Processes in Antiferromagnetics AUTHORS:

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.5, pp.797-798

The method put forward by Akhiyezer (Ref.1) and Kaganov and Tsukernik (Ref.2) is used to calculate the mean probabilities of processes associated with the interaction between spin waves in ferromagnetics. The theory holds in the temperature region

 $\mathbf{\Theta_{c}} \left(\frac{\mu_{o} M_{o}}{\mathbf{\Theta_{c}}} \right)^{1/2} \, \ll \, \tau \, \ll \mathbf{\Theta_{c}}$

in which the energy of the spin wave is given by the well-known expression

$$\epsilon_{\lambda} = \Theta_{c}(ak_{\lambda})$$

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85974 5/126/60/010/005/029/030 E032/E414

Theory of Relaxation Processes in Antiferromagnetics

The notation is defined in the previous paper by the present authors (Ref.3). The processes considered are: (a) combination of two spin waves into one, and (b) collision of two spin waves. The probability of other processes, for example combination of three spin waves into one, have zero probability since energy and three spin waves into one, have zero probability since energy and momentum conservation laws cannot be satisfied at the same time. It is found that the mean probabilities for the above two processes are respectively given by

$$\overline{w}_3 \approx \frac{\Theta_c}{h} \left(\frac{\mu_0 M_0}{\Theta_c} \right)^{5/2} \frac{T}{\Theta_c}$$
 (3)

$$\overline{W}_{4} \approx \frac{\Theta_{c}}{h} \left(\frac{T}{\Theta_{c}}\right)^{5}$$
 (4)

Comparison of these two probabilities shows that in the above Card 2/3

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Theory of Relaxation Processes in Antiferromagnetics

temperature region the non-homogeneous exchange interaction is responsible for setting up the thermodynamic equilibrium in a spin wave system. Acknowledgments are expressed to V.G.Bar'yakhtara for valuable discussions. There are 3 Soviet references.

ASSOCIATIONS:

Fiziko-tekhnicheskiy institut AN USSR (Physical-Technical Institute AS UkrSSR)
Khar'kovskiy gosudarstvennyy universitet
im. A.M.Gor'kogo (Khar'kov State University
im. A.M.Gor'kiy)

SUBMITTED:

April 18, 1960

Card 3/3

83743 s/056/60/038/004/036/048 B006/B056

9.4300 (1035,1138,1143)

24.7900 AUTHORS:

Kaganov, M. I., Tsukernik, V. M.

TITLE:

Nonresonance Absorption of the Energy of an Alternating

Magnetic Field by a Ferromagnetic Dielectric.

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,

Vol. 38, No. 4, pp. 1320 - 1325

TEXT: In part I of the present paper, the nonresonance absorption of the energy of an alternating magnetic field by a ferromagnetic dielectric has already been investigated on the assumption that this field is polarized in the direction of the axis of easiest magnetization. The case is now dealt with, in which the field is polarized perpendicular to this axis. These two cases are described as longitudinal and transverse fields. Contrary to what is the case in a longitudinal field, energy absorption may occur in a transverse field even if no dissipative processes occur, but when the field frequency agrees with the ferromagnetic resonance frequency. Neither resonance nor the effects connected with it are considered. The results obtained here relate to frequencies

Card 1/3

837****3 \$/056/60/038/004/036/048

B006/B056

Nonresonance Absorption of the Energy of an Alternating Magnetic Field by a Ferromagnetic Dielectric. II

that are distant from resonance. The dissipative processes connected with the energy absorption are caused by the interaction between the magnetic field and the spin waves. The authors assume (like in Ref. 1) that the ferromagnetic dielectric is magnetized up to saturation at a given temperature, i.e., that it may be considered to be a single-domain sample. The sample is also considered to be sufficiently pure, so that impurity effects may be neglected. It is shown that the nonresonance absorption of magnetic field energy is connected with the forming of two spin waves as a result of a "collision" between a photon and a spin wave. Besides, an absorption of the photon in higher perturbation-theoretical approximations is possible due to processes in which a large number of spin waves participate. The most important process in this case is one of the fifth order, which occurs in second perturbationtheoretical approximation. The coefficient of the absorption of magnetic field energy $\Gamma = Q \left(\frac{h_0^2}{8\pi} V\right)^{-1}$ is now investigated, where Q denotes the amount of energy absorbed per second within the entire sample volume.

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83743

Nonresonance Absorption of the Energy of an S/056/60/038/004/036/048 Alternating Magnetic Field by a Ferro-B006/B056 magnetic Dielectric. II

One obtains $\Gamma = \frac{1}{32\pi^2} \frac{w^2 T^2}{\mu M_o \theta_c^3} \omega (1 - e^{-\frac{N}{\hbar}\omega/T}) I(\gamma, \nu)$, where $\gamma = \mu H_e/T$ and

 $\mathcal{V} = \hbar \omega/T$; the function $I(\gamma, \mathcal{V})$ is represented as an integral equation by (13) and (13). These equations are integrated for the special cases of low frequencies ($\mathcal{V} \not\in 1, \eta$), resonance frequency ($\mathcal{V} = \gamma$), and high frequencies ($1 \gg \mathcal{V} \gg \eta$; $\mathcal{V} \gg 1 \gg \gamma$; $\gamma \gg \mathcal{V} \gg 1$; $\mathcal{V} \gg \eta \gg 1$). The resulting asymptotic values of the integrals are used to determine approximate formulas for Γ in the various special cases. The authors thank A. I. Akhiyezer and \mathcal{V} . G. Bar'yakhtar for discussions. There are 3 references: 2 Soviet and 1 US.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Institute of Physics and Technology of the Academy of

Sciences Ukrainskaya SSR)

SUBMITTED: November 23, 1959

Card 3/3

s/056/60/039/002/044/044 B006/B070

Kaganov, M. I., Tsukernik, V. M. AUTHORS:

Theory of the Non-resonant Absorption of a Variable Magnetic Field by a Ferromagnetic Dielectric TITLE:

Zhurnal eksperimental noy i teoreticheskoy fiziki, 1960,

Vol. 39, No. 2(8), p. 518 PERIODICAL:

TEXT: In an earlier paper, the authors calculated the absorption coefficient of a variable magnetic field polarized perpendicular to the axis of easiest magnetization. The Hamiltonian used in that case took only the exchange interaction into account. Later, Tsukernik showed that in this case only resonance absorption of a homogeneous magnetic alternating field may take place, since the total magnetic moment commutes with the Hamiltonian of the system; the results of the earlier paper (Ref. 1) are therefore wrong. The error is related to the fact that in the calculation of the matrix elements of the transition, the authors restricted themselves to the first approximation of the perturbation theory. A consideration of the second approximation shows that the matrix

Card 1/2

Theory of the Non-resonant Absorption of a Variable Magnetic Field by a Ferromagnetic Dielectric

s/056/60/039/002/044/044 B006/B070

element vanishes to the corresponding accuracy. The non-resonant absorption of the homogeneous field is related to the relativistic interactions in the system (dipole-dipole interaction, anisotropy energy, etc.). These problems will be considered in a later paper. Here, the authors give only a formula for the coefficient of absorption of a transverse magnetic field whose frequency is considerably smaller than that of the spin wave in the case of a zero quasi-momentum. The absorption described by this formula is due to a decay of a photon into two spin waves with oppositely directed quasi-momenta. There is 1 Soviet reference.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Institute of Physics and Technology of the Academy of

Sciences Ukrainskaya SSR)

July 2, 1960 SUBMITTED:

Card 2/2

ACCESSION MR: APLO19844

s/0181/64/006/003/0818/0826

AUTHORS: Genkin, G. M.; Golubeva, N. G.; Tsukornik, V. M.

TITLE: The spin phonon width of lines of antiferromagnetic resonance

SOUPCE: Fizika tverdogo tela, v. 6, no. 3, 1964, 818-826

TOPIC TAGS: spin phonon interaction, magnetic resonance, magnetization precession, exchange interaction, antiferromagnetism

ABSTRACT: The authors have examined the relaxation of the uniform precession of magnetization in a uniaxial antiferromagnetic as a consequence of interaction between spin waves and phonons (both acoustical and optical). They show that the relaxation processes of creating (or absorbing) an acoustical phonon by a spin wave, by virtue of the law of conservation of energy and momentum, may take place only at frequencies of

 $\omega_0 > \omega_0^{\text{gr}} = \frac{\sqrt{3h_A} v}{a}$

where $\omega_{_{0}}$ is the frequency of antiferromagnetic resonance, $h_{_{A}}$ is the field of Card 1/2

ACCESSION NR: AP4019844

anisotropy, v the velocity of sound, and a the lattice constant. The interaction is an exchange process. The width of the line has been computed for any temperature. At rather high frequencies of antiferromagnetic resonance, $\omega_0 > \omega_0^{\rm gr}$, where normally $\omega_0^{\rm gr} \sim 2 \cdot 10^{12} \, {\rm sec^{-1}deg}$, the spin-phonon line width at low temperatures proves to be much greater than spin-spin line width. At frequencies of $\omega_0 < \omega_0^{\rm gr}$, the spin-phonon width is small compared to spin-spin width, except for regions of very low temperatures (T < 10-3K). Orig. art. has: 39 formulas.

ASSOCIATION: Radiofizicheskiy institut, Gorkiy (Radiophysical Institute)

SUBMITTED: 21Sep63

DATE ACQ: 31Mar64

ENCL: 00

SUB CODE: SS, EM

NO REF SOV: 003

OTHER: 008

Card 2/2

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300a) \$/048/61/025/011/007/031 B108/B138

AUTHORS:

Kaganov, M. I., and Tsukernik, V. H.

TITLE:

Off-resonance absorption of a variable magnetic field by

ferromagnetic dielectrics at low temperatures

PERIODICAL:

Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya,

v. 25, no. 11, 1961, 1346-1351

TEXT: The authors studied the absorption of an h.f. magnetic field whose plane of circular polarization is perpendicular to the equilibrium magnetic moment of the ferromagnetic. They consider absorption without resonance, which can only occur by the interaction of spin waves with one another and with phonons. The calculations are made for temperatures considerably below the Curie point $\Theta_{\mathbf{C}}$. The absorption coefficient Γ of the magnetic field is given as $\Gamma = \frac{8\pi k_D}{h_D^2 V} \sum_{i} \left\{ w_{if} - w_{fi} \right\}$, where w_{if} is the

probability of direct, and $\mathbf{W}_{\mathbf{fi}}$ of inverse, transition. The absorption

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Off-resonance absorption of a...

coefficient due to spin-spin interaction is evaluated for two limiting cases: (1) High temperatures $T\gg\epsilon_o$ (tut still $T\ll\theta_c$):

$$\Gamma_{ss} \approx \begin{cases} A_1 \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_1}{\theta_c} \cdot \frac{\hbar \omega T^2}{\epsilon_0^3}, & \hbar \omega \ll \epsilon_0, \\ A_2 g M_0 \left(\frac{w}{\theta_c}\right)^2 \frac{T^2}{\hbar \omega \theta_c}, & \epsilon_0 \ll \hbar \omega \ll T, \\ \frac{4}{15} \sqrt{\frac{\pi}{2}} \zeta(3/1) g M_0 \left(\frac{w}{\theta_c}\right)^2 \frac{T'^{1s}}{(\hbar \omega)^{1/1}} \frac{1}{\theta_c}, & \hbar \omega \gg T, \end{cases}$$
(17)

where $w = \frac{\mu^2}{a^3}$ is the dipole-dipole interaction energy; $A_1 \sim A_2 \sim 10^3$. (2) Low temperatures $(T \ll \epsilon_0)$:

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Off-resonance absorption of a...

$$\Gamma_{3s} \approx \begin{cases} B_1 \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_0}{\theta_c} \frac{\hbar \omega T^{3/s}}{\varepsilon_0^{1/s}} e^{-\frac{3\varepsilon_0}{T}}, & \hbar \omega \ll \varepsilon_0, \\ \frac{4}{15} \sqrt{\frac{\pi}{2}} \omega \left(\frac{w}{\theta_c}\right)^2 \frac{\mu M_0}{\theta_c} \left(\frac{T}{\varepsilon_{ss}}\right)^{3/s} e^{-\frac{3\varepsilon_0}{T}}, & \hbar \omega \gg \varepsilon_0, \end{cases}$$
(18)

where

$$B_1 = \frac{15\pi^{\frac{1}{2}}}{8\sqrt{2}} \left\{ 121 + \frac{1}{15} \left[\left(\frac{2\beta}{\pi} - \frac{2}{3} \right)^2 + \frac{121}{45} \right] \right\} + \frac{4}{15} \sqrt{\frac{\pi}{2}} \approx 10^4$$

 $\epsilon_0 = \mu H_0 + \beta \mu M_0$ where H_0 denotes the permanent magnetic field along the axis of casiest magnetization, H_0 the equilibrium magnetic moment, β the anisotropy constant, a the lattice constant, $\mu = g \hbar$, g the gyromagnetic ratio. The results for spin-lattice interaction show that these contributions to the overall absorption coefficient are considerably smaller than the contribution due to spin-spin interaction. The considerations have been made for perfect ferromagnetics without

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"APPROVED FOR RELEASE: 04/03/2001 CIA-RDP86-00513R001757210007-1

Off-resonance absorption of a...

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impurities. I. M. Lifshits is thanked to discussions. This paper was read at the Conference on ferromagnetism and antiferromagnetism in Leningrad, May 5-11, 1961. There are 1 figure and 4 Soviet references.

ASSOCIAT OF: Fiziko-tekhnicheskiy institut Akademii nauk USSR
(Physicotechnical Institute of the Academy of Sciences Ukruss.)

24,7900 (1055,1144,1163) 24.2200 1164 1068 1121 30064 \$/048/61/025/011/008/031 B108/B138

AUTHORS:

Kaganov, M. I., and Tsukernik, V. M.

TITLE:

An absorption mechanism for a longitudinal magnetic field by

a ferromagnetic dielectric

PERIODICAL:

Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya,

v. 25, no. 11, 1961, 1352-1353

TEXT: The ferro-dielectric absorption of the energy of a variable magnetic field polarized along the axis of easiest magnetization was studied in detail in a previous paper (Ref. 1: $\mathbb{Z}h$. eksperim. i teor. fiz., $\underline{37}$, 823 (1959)). The absorption of the field at $\omega \tau_{ss} \ll 1$, where τ_{ss} is relaxation

time, was calculated with the aid of the kinetic equations for the distribution function of the spin waves. The calculations were made for temperatures T considerably below Curie point $\theta_{\rm C}$. At high frequencies, absorption is chiefly determined by the disintegration of a photon into two spin waves with opposite momenta. This process was also considered in the above paper. It was pointed out, however, that a photon will only

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An absorption mechanism for a...

disintegrate into two spin waves at frequencies ω greater than $\frac{2\epsilon_0}{\frac{1}{\hbar}}$, where ϵ_0 is the energy of a zero-momentum spin wave. The wide range $\frac{1}{\tau} \ll \omega < \frac{2\epsilon_0}{\hbar}$ has not been considered as yet. Absorption in this range is the subject of the present paper. In the lowest spin-wave approximation, the Hamiltonian for spin wave interaction with one another and with a longitudinal magnetic field is $H' = H_{int} + H_{h}$ (1) where $H_{int} = \sum_{123} \Phi_{12;3} a_{1}^{+} a_{2}^{+} a_{3}^{+} + \text{complex conjugate (2)}$ and $H_{h} = \frac{1}{2} \mu h_{o} (e^{i\omega t} + e^{-i\omega t}) \sum_{k} a_{k}^{+} a_{k}$ (21). h_{o} denotes the amplitude of

the variable field. The other notations may be found in Ref. 2 (Akhiyezer&I. et al., Uspekhi fiz. nauk, 71, 533 (1960)). In the approximation in question (second approximation in perturbation theory), strong exchange interaction does not contribute to absorption. It can be seen from the (1) and (2) that the transition matrix elements that are linear with respect to the variable field are nonvanishing only in second and higher perturbation-theoretical approximation. The corresponding lowest order processes are: (a) merging of a photon and a spin wave, which form two spin waves and (b) merging of two spin waves and one photon to form one spin wave. The

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calculation of the appropriate absorption coefficients Γ_a and Γ_b is similar to that given in detail in Ref. 3 (Kaganov M. I., Tsukernik V. M., present number of this periodical, p. 1346). In this article, only the final results for the total absorption coefficient $\Gamma = \Gamma_a + \Gamma_b$ are given, with precision up to a numerical factor of the order of unity. At high temperatures ($\epsilon_o \ll T \leqslant \theta_c$)

$$\Gamma \sim \begin{cases} gM_0 \frac{w^2}{\varepsilon_0 \theta_c} \left(\frac{T}{\theta_c}\right)^2, & \frac{\hbar}{\tau_{ss}} \ll \hbar\omega \ll \varepsilon_0, \\ gM_0 \frac{w^2}{\hbar\omega \theta_c} \left(\frac{T}{\theta_c}\right)^2, & \varepsilon_0 \ll \hbar\omega \ll T, \\ gM_0 \frac{w^2}{\theta_c^{\prime\prime\prime} (\hbar\omega)^{\prime\prime\prime\prime}} \left(\frac{T}{\theta_c}\right)^{\prime\prime\prime}, & T \ll \hbar\omega \ll \theta_c. \end{cases}$$

. At low temperatures (T≪ε_o)

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$$\Gamma \sim \begin{cases} gM_0 \frac{w^4}{\theta_c^2} \left(\frac{e_0}{\theta_c}\right)^{1/s} \left(\frac{T}{\theta_c}\right)^{1/s} e^{-\frac{3\epsilon_0}{T}}, \frac{\hbar}{\tau_{ss}} \ll \hbar\omega \ll \epsilon_0, \\ gM_0 \frac{w^2}{\theta_c^{1/s} (\hbar\omega)^{1/s}} \left(\frac{T}{\theta_c}\right)^{1/s} e^{-\frac{\epsilon_0}{T}}, \quad \hbar\omega \gg \epsilon_0. \end{cases}$$

Comparison of the results obtained with the absorption coefficient due to the disintegration of one photon into two spin waves (Ref. 1) shows that the processes considered in this paper are only effective at $\hbar\omega < 2\varepsilon_0$. [Abstracter's note: Complete translation.] This paper was read at the Conference on ferromagnetism and antiferromagnetism in Leningrad, May 5-11, 1961. There are 3 Soviet references.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk USSR (Physicotechnical Institute of the Academy of Sciences UkrSSR)

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"APPROVED FOR RELEASE: 04/03/2001 CIA-RDP86-00513R001757210007-1

LESSIE IV	24,2200	26l, 2lt, 8/056/61/041/001/019/021 B102/B231	
	AUTHORS's	Kaganov, M. I., Tsukernik, V. M.	10
	TITLE:	High-frequency magnetic susceptibility of uniaxial ferromagnetic crystal in a longitudinal magnetic field	
	PERIODICAL:	Zhurnal eksperimental noy i teoreticheskoy fiziki, v. 41, no. 1(7), 1961, 267 - 271	15
	mainly due to magnetic field in this case: frequencies of computed for 85, 329, 1952 paper (ZhETF, computed the	tibility dispersion of an antiferromagnetic material is rotation of the magnetic moments of the sublattices in a l. The imaginary part of & exhibits a resonance character resonance frequency coincides with the natural rotation f the system of moments. These frequencies have been various equilibrium configurations by C. Kittel (Phys. Rev., and Ye. A. Turov (ZhETF, 34, 1009, 1958). In an earlier 24, 524, 1958), the authors of the present work have hef susceptibility of a uniaxial antiferromagnetic body tic field. If the magnetic field is strong enough, the onfiguration of the sublattice moments may change, which	20
	Card 1/7	· · · · · · · · · · · · · · · · · · ·	30

26h2h \$/056/61/041/001/019/021 B102/B231 High-frequency magnetic! :.. would result in a change of the dispersion character. Starting from the Landau-Lifshits equations for the motion of the sublattice moments, the h-f susceptibility tensor of an antiferromagnetic body is computed for various values of the constant magnetic field strength, that is, for various equilibrium configurations of the moments. The results permit to draw conclusions from h-f measurements as to the equilibrium structures and the transitions between them. The uniaxial antiferromagnetic body is assumed to have two sublattices and to be positioned in a homogeneous, constant and in a weak and variable (frequency ω) magnetic field. motion of the moments due to field action is described by $\partial M_s / \partial t = g \left[M_s H_s^{(s)} \right] - (\gamma / M^s) \left[\dot{M}_s \left[M_s H_s \right] \right],$ 50 $(1)_{s}$ where \overrightarrow{M}_{a} is the magnetization vector of the s-th sublattice, M the sublattice magnetization which is assumed to be constant, g the syromagnetic ratio, the relaxation constant, H(s) the effective field - 3 X/3 M, where X stands for the acting upon the s-th sublattice: energy density of the antiferromagnetic body: Card 2/7

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High-frequency magnetic ...

 $\mathcal{H} = \alpha M_1 M_2 - \frac{1}{2} \chi \left[(M_1 n)^2 + (M_2 n)^2 \right] + \eta \left(M_1 n \right) (M_2 n) - H (M_1 + M_2).$

Here, α is the constant of exchange interaction $(\alpha>0), \lambda$ and γ represent the anisotropy constants which are assumed to be positive; n is the unit vector in the direction of the axis of the antiferromagnetic body. Using the notation stated hereinafter: $H_1 = \sqrt{(\lambda + \eta)(2\alpha - \lambda + \eta)}M$,

 $\begin{array}{lll} H_2 = \sqrt{(\lambda + \eta) (2\alpha + \lambda + \eta)} H, & H = H_3 = (2\alpha - \lambda + \eta)M, \text{ and} \\ H_4 = \left[\lambda(2\alpha - \lambda + \eta)^2/(2\alpha + \lambda + \eta)\right]^{1/2} M & (H_4 < H_1; H_2 - H_4 \text{ is the width of} \end{array}$ the hysteresis loop of the antiferromagnetic body), the following cases are the hysteresis loop of the antiferromagnetic body), the following cases are subjected to investigation: 1) H < H₁. m_{\pm} is equal to χ_{\pm}^h , where $h_{\pm} = h_x \pm ih_y$, $m_{\pm} = m_x \pm im_y$, \tilde{h} stands for the h-f magnetic field, and \tilde{m} for

the variable part of the entire magnetic moment. With

 $\Omega^2 = (g^2 M^2 + \gamma^2) (\lambda + \eta) (2\alpha + \lambda + \eta) - \gamma^2 H^2/M^2,$ $\Omega_1^2 = 2 (g^2 M^2 + \gamma^2) (\lambda + \eta),$

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High-frequency magnetic ...

the following is obtained:

$$\chi_{\pm} = \frac{\Omega_1^2 - 2lo\gamma}{\Omega^2 - (\omega + gH)^2 - 2i\omega\gamma(\alpha + \lambda + \eta)}, \quad \chi_{zz} = 0.$$
 (6)

The width of the antiferromagnetic resonance lines is thus given by $2\chi(\alpha+\lambda+\gamma)$. With H = 0 one has $\chi_+=\chi_-=\chi_{xx}=\chi_{yy}$. 2) $H_1< H< H_3$. Here, $\chi_{zz}\neq 0$, and the following is obtained:

$$\chi_{zz}(\omega) = \chi_{zz}(0) \frac{v^2 + iv\omega}{v^2 + \omega^2}; \qquad (7)$$

$$\chi_{zz}(0) = \frac{2}{(2\alpha - \lambda + \eta)},
\nu = (2\alpha - \lambda + \eta) \frac{\gamma \sin^2 0}{(1 - H^2/H_0^2)} H_2/M.$$
(8)

From this, the following is obtained for the behavior of the relaxation time $\mathcal{C} = 1/\nu$ in the vicinity of the point of second-kind phase transition (with $H \approx H$):

 $T = \frac{1}{3} \frac{1}{H_3^2 - H^2}$. If T is fixed, and H = H₃ the following is valid:

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High-frequency magnetic ...

$$\tau = \frac{G}{|T_{\kappa} - T|}, G = M/2\gamma \left| \frac{dH_3}{dT} \right|_{T - T_{\kappa}}$$
 (5"),

where T_k is the temperature of phase transition. This means that with the frequency being fixed there is a field or a temperature at which the h-f field (polarized along z) exhibits an absorption maximum whose position and height is dependent on w. The transverse components are in this case given, by

$$\chi_{xx} = \frac{\omega_1^2 - 2i\omega\gamma}{\omega_0^2 - \omega^2 - 2i\alpha\gamma'\omega} \cos^2 \theta,$$

$$\chi_{yy} = \frac{1}{\alpha} \frac{\omega_0^2 - 2i\omega\gamma}{\omega_0^2 - \omega^2 - 2i\alpha\gamma'\omega},$$

$$\chi_{xy} = -\gamma_{yx} = \frac{2igM\omega\cos\theta}{\omega_0^2 - \omega^2 - 2i\alpha\gamma'\omega}.$$
(9),

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where

$$\omega_0^2 = (g^2 M^2 + \gamma^2) (4\alpha^2 \cos^2 \theta - 2 (\lambda + \eta) \alpha \sin^2 \theta), \qquad (10)$$

$$\omega_1^2 = 4\alpha (g^2 M^2 + \gamma^2), \qquad \gamma' = \gamma [1 + \cos^2 \theta - \frac{1}{2\alpha} (\lambda + \eta) \sin^2 \theta].$$

3) $H > H_3$, $(\widehat{H} \parallel \widehat{h})$. Here, the tensor of h-f susceptibility coincides with that of the susceptibility of the uniaxial antiferromagnetic body:

$$\chi_{xx}(\omega) = \chi_{yy}(\omega) = \chi_{\perp}(0) \frac{\omega_{\phi}^{2} - i\omega\gamma_{\phi}}{\omega_{\phi}^{2} - \omega^{2} - 2i\omega\gamma_{\phi}},$$

$$\chi_{xy}(\omega) = -\chi_{yx}(\omega) = \frac{2igM\omega}{\omega_{\phi}^{2} - \omega^{2} - 2i\omega\gamma_{\phi}},$$

$$\chi_{xx} = \chi_{yz} = \chi_{zz} = 0,$$
(11),

$$\chi_{\perp}(0) = 2M/(H + (\lambda - \eta) M),$$

$$\omega_{\Phi}^{\epsilon} = g^{2} [H + (\lambda - \eta) M]^{2} (1 + \gamma^{2}/g^{2}M^{2}),$$

$$\gamma_{\Phi} = \gamma (H/M + \lambda - \eta).$$
(.12)

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High-frequency magnetic ...

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With $H=H_3=(2\alpha-\lambda+\gamma)M$ all components of $\chi_{ik}(\omega)$ are continuous. The authors thank A. S. Borovik-Romanov for remarks. There are 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii naur Ukrainskoy SSR (Institute of Physics and Technology of the Academy of Sciences Ukrainskaya SSR)

SUBMITTED: February 17, 1961

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Card 7/7

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s/056/62/043/003/037/063 > B108/B102

Gurzhi, R. N., Tsukernik, V. M. AUTHORS:

High-frequency magnetic susceptibility of ferromagnetic TITLE: dielectrics in a longitudinal magnetic field

PERIODICAL: Zhurnal eksperimental noy i teoreticheskoy fiziki, . . . , v. . 43, no. 3(9), 1962, 977 - 983

TEXT: Using a method-similar to Bogolyubov's (ZhETF, 17, 614, 1947) the authors got the following quantum kinetic equation (linear approximation. with regard to the variable field $h_t = h_0 e^{-i\omega t}$) for the distribution function $F_k = \langle a_k^+ a_k^- \rangle$ of spin waves:

> $-i\omega f_k = L_k h_0 + \hat{W} f_k;$ (11) $L_k = (\pi\mu\omega/2) |B_k|^2 (2\widetilde{n}_k + 1) \widetilde{\epsilon}_k^{-3} [\delta_- (-2\widetilde{\epsilon}_k - \hbar\omega) - \delta_- (2\widetilde{\epsilon}_k - \hbar\omega)] +$ $+4\pi\mu\omega\sum_{13}\frac{|\Phi_{k1;\;2}|^2}{\epsilon_{k1;\;2}^2}\left[(1+n_k+n_1)\,n_2-n_1n_k\right]\left[\delta_{-}\left(\epsilon_{2;\;1k}-\hbar\omega\right)-\delta_{-}\left(\epsilon_{k1;\;2}-\hbar\omega\right)\right]+$

High-frequency magnetic... 8/056/62/043/003/037/063 B108/B102 with $F_{\alpha}|_{t=0} = n_{\alpha} = (e^{\frac{\epsilon}{\alpha}/T} - 1)^{-1}$ and $(a_{\alpha}^{\dagger}a_{\beta}^{\dagger}a_{\gamma}^{\dagger})|_{t=0} = 0$. $\epsilon_{k} = |\theta_{\text{Curie}}(ak)|^{2} + \mu_{\text{H}} + |B_{k}|$. At high frequencies it is sufficient to consider the term $-i\omega f_{k} = L_{k}h_{o}$. From this equation the high-frequency magnetic susceptibility of a ferrodielectric with one magnetic sublattice can be calculated keeping in mind that magnetization too can be expressed in terms of the spin wave distribution function:

 $V_{z}^{-1}\langle \mathfrak{M}_{z}\rangle = M_{0} - \frac{\mu}{V} \sum_{k} \langle a_{k}^{\dagger} a_{k} \rangle, \qquad \langle a_{k}^{\dagger} a_{k} \rangle = \operatorname{Sp} \rho a_{k}^{\dagger} a_{k}, \qquad (6)$

Thus, $\chi = -\frac{i\omega}{\omega V}\sum_{k}L_{k}$. V is the volume of the body. The real part of magnetic susceptibility which is related to dispersion is

 $Re\chi = \frac{\mu}{\omega V} \sum_{k} Im L_{k}$

The predominant term in Im L_k is the one proportional to $|B_k|^2$. Con-

Card 3/4

High-frequency magnetic... S/056/62/043/003/037/063 B108/B102sidering this and using the symbols $x = \sqrt{\theta_{\text{Curie}}}/T$ ak, $\alpha = h_{\omega}/T$, $\eta = \mu H/T$, $\gamma = 4\pi \mu M_{\text{O}}/T$ and $w = \mu^2/a^3$ the result is $Re \chi = \frac{w}{4T} \left(\frac{\mu M_0}{T}\right)^3 \left(\frac{T}{\theta_c}\right)^{\eta_c} \int_0^{\pi} \sin^a \theta d\theta \int_{-\infty}^{\infty} \frac{\text{clh}(y(x)/2)}{y(x)} \frac{x^3 dx}{y^2(x) - \alpha^{1/4}},$ $y(x) = V(x^2 + \eta)^2 + \gamma(x^2 + \eta) \sin^2 \theta.$ ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Physicotechnical Institute of the Academy of Sciences of the Ukrainskaya SSR)
SUBMITTED: March 31, 1962

L 40173-66 EVIT(1) JW

ACC NR: AP6018817

SOURCE CODE: UR/0056/66/050/005/1377/1380

AUTHOR: Pikin, S. A.; Tsukernik, V. M.

ORG: none

TITLE: Thermodynamics of linear spin chains in a transverse magnetic field

SOURCE: Zh eksper i teor fiz, v. 50, no. 5, 1966, 1377-1380

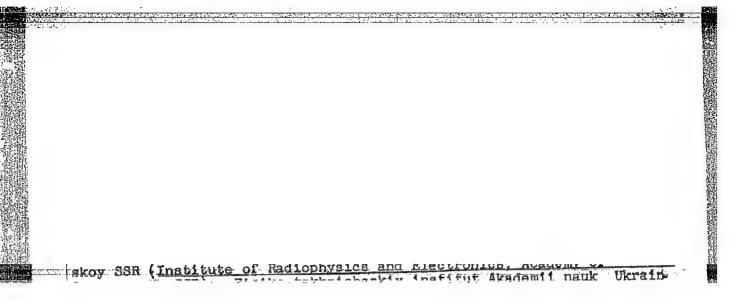
TOPIC TAGS: spin system, transverse magnetic field, magnetic susceptibility, THERMODYNAMIC PROPERTY, HOMO SENFOUS MAGNETIC FIELD

ABSTRACT: A one-dimensional system of spins (s = 1/2) with a strongly sinisotropic interaction of the immediate neighbors has been examined. The system is assumed to be in a homogeneous magnetic field directed along a given axis. Exact equations have been obtained for the thermodynamic characteristics of the system. It has been shown that at T = 0 and an absolute value of the magnetic-field strength H₀, the magnetic susceptibility has a logarithmic or root nature, dependent, like H₀, on the relation between the interaction constants. The authors thank V. G. Yaka and A. I. Larkin for valuable discussions. Orig. art, has: Informulas. [Based on authors! abstract]

SUB CODE: 20/ SUBM DATE: 03Dec65/ ORIG REF: 003/ OTH REF: 002

L 41744-66 EWT(1) IJP(c) SOURCE CODE: UR/0056/66/050/006/1631/1635 ACC NR: AP6020219 AUTHOR: Tsukernik, V. M. ORG: none TITLE: Features of gyromagnetic effect in ferrodielectrics at low temperatures SOURCE: Zh eksper i teor fiz, v. 50, no. 6, 1966, 1631-1635 TOPIC TAGS: ferromagnetic dielectric, spin wave theory, dipole interaction, magnetic moment, ground state, temperature dependence ABSTRACT: The author derives in the spin-wave approximation a formula for the temperature part of the mechanical moment of a spin system and shows that in the region of temperatures where the dipole interaction plays an important role, its ratio to the corresponding addition to the magnetic moment differs from the single-electron g factor and depends on the temperature. The approximation employed consists of expanding, with accuracy to quadratic terms, the energy density in powers of a quantity which is small near the ground state in comparison with the magnetization, followed by quantization and averaging with an equilibrium Gibbs distribution. The deduced dffference in the temperature dependence of the magnetic and mechanical moments of the spin system is observable in principle with the aid of a gyromagnetic experiment in which the moments are changed as a result of changes in the temperature in the absence of an external field. The author thanks M. I. Kaganov for useful discussions. Orig. art. has: 20 formulas. ORIG. REF: 004 SUBM DATE: 18 Jan 65/ SUB CODE:

SOURCE: Zhurnal eksperimental not y 1 teoretic section of the magnetic field strength has a well defined value. The states of the electromagnetic field attender the problem of the magnetic field strength has a well defined value. The states of the electromagnetic field attender to the magnetic field strength has a well defined value. The states of the electromagnetic field attength is given in all of space at one particular time, so that a complete set of the values of the electrical (or magnetic) field attength can be chosen in all



NR REF SOV: 003

ZAMERROV, 4.0; LECHER, N.A.; LEKONTSEV, A.N.; REDNITSKIY, P.M.; TOLKLALKINKO, I.N.; TSCHERNIK, Z.G.; ARYAEOV, N.I., inzh., inchenzent; DOVGOFOL, V.I., red.; DCBROV, h.P., red.; GETI HNG, Yu., red.

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(Iron-Metallurgy) (Steel-Metallurgy) (Metalwork)

IGNATIK, A.F., inzh.; TSUKERNIK, Z.S., inzh.

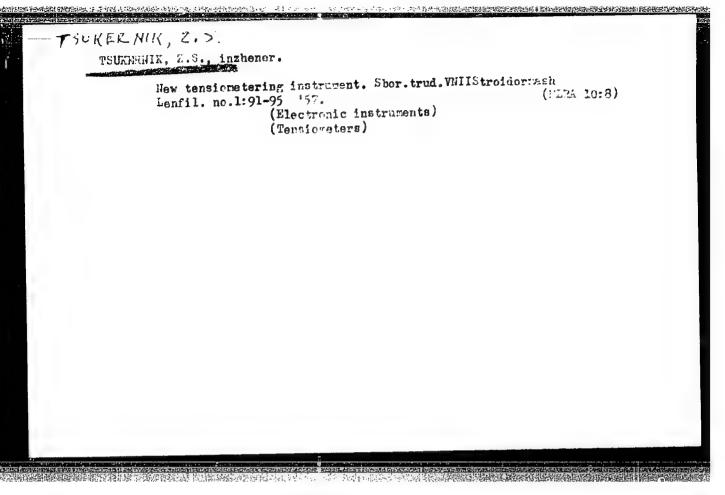
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(Radioactive tracers--Industrial applications)

(Concrete--Transportation)



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1. Of the Naval Medical Academy.

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Probl.gemat. i perel.krovi 4 no.7:49-52 Jl '59.

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1. Ig I Leningradskogo meditsinskogo instituta imeni akad.
I.P.Pavlova.

(TAFEWORM INFECTION, compl.
diphyllobothriasis causing anemia (Rus))

(AMEMIA, etiol. & pathogen.
diphyllobothriasis (Rus))

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(BLOOD—RXAMINATION)

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Diagnosis of internal biliary fistulas; symptom of gas in bile ducts. Klin. (MLRA 6:11)

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TSUKERSHTEYN, 0.Ye., kand.med.nauk

C.se of diabetes mellitus developing under the influence of ACTH and cortisone. Probl.endok.i gorm. no.1:115-116 162.

(ACTH) (CORTISONE) (DIAHETES)

(ACTH) (CORTISONE)

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"Leukemoid Reactions During Intoxication With Tetraethyl Lead",
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(LEUCOCYTOSIS) (RHEUMATIC FEVER)

(LEUCOCYTOSIS)

TSUKERSHTEYN, V.G., and RUDERMAN, A.I.

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"Experimental Studies on the Distribution of X-ray Radiation Doses when Sectorial Irradiation by Mesns of Swinging X-ray Tubes is being applied", p. 165. Research Into the Field of X-Ray Technique, Vol. 9, Medgiz, Moscow 1955

MERSTHER CONTROL OF THE PROPERTY OF THE PROPER RUDERMAN, A.I., doktor med. nauk; TSUKERSHTEYN, V.G.. Indications for X-ray treatment of esophageal cancer by sector irradiation with a pivoting tube. Trudy TSentr. nauch.-issl. inst. rentg. i rad. 10:226-230 59. (MIRA 12:9) (ESOPHAGUS-CANCER) (X RAYS-THERAPEUTIC USE)

TSUKERSHTEYN, V.G.	
	X-ray treatment of benign vascular tumors. Trudy TSentr. rauch issl. inst. rentg. i rad. 10:273-278 '59. (MIRA 10:9) (X RAYSTHERAPEUTIC USE) (TUMORS)

RUDERMAN. A.I.: TSUKKRSHTEYN, V.G.

Experimental study of the distribution of X-ray emission in the case of sectional exposure by oscillating tubes. Trudy TSentr. nauchn. issl.inst.rentg. i rad. 9:165-173 155. (MLRA 9:12)

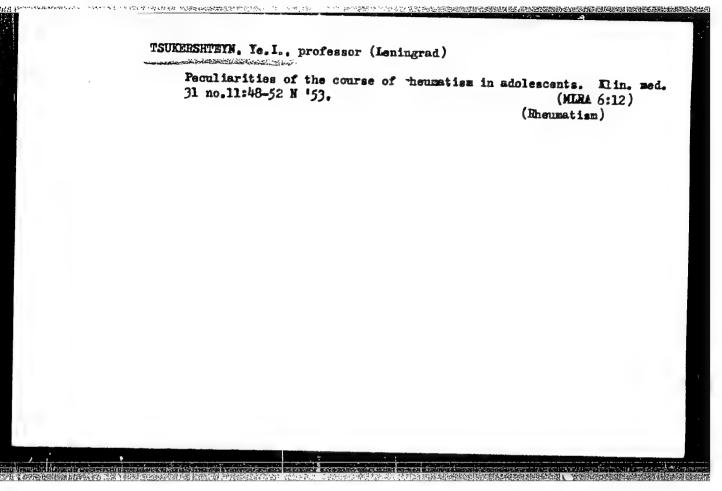
(X RAYS)

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TSUKERSHTEYN, Ye.I.: YNGOROVA, M.N.

Berrier liver function in hypertension. Klin. med., Moskva 30 no. 11:90 Nov 1952. (CLML 23:5)

1. Professor for Tsukershteyn. 2. Of the Third Department of Internal Diseases (Head -- Prof. Ye. I. Tsukershteyn), State Order of Lenin Institute for the Advanced Training of Physicians imeni S. M. Kirov.



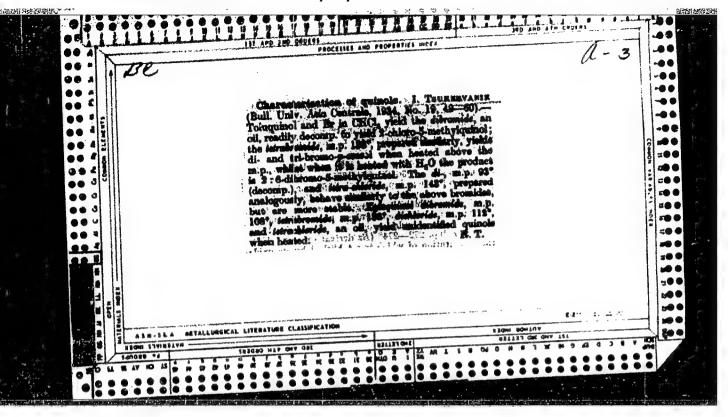
TSUKERSHTEYN, Ye.I., prof.; TNIMOVA, K.Z., dotsent

Peculiarities in the clinical aspects and treatment of tuberculosis of the lymph nodes of the abdominal cavity. Zdrav. Kazakh. 21 no.1: 43-48 '61. (MIRA 14:3)

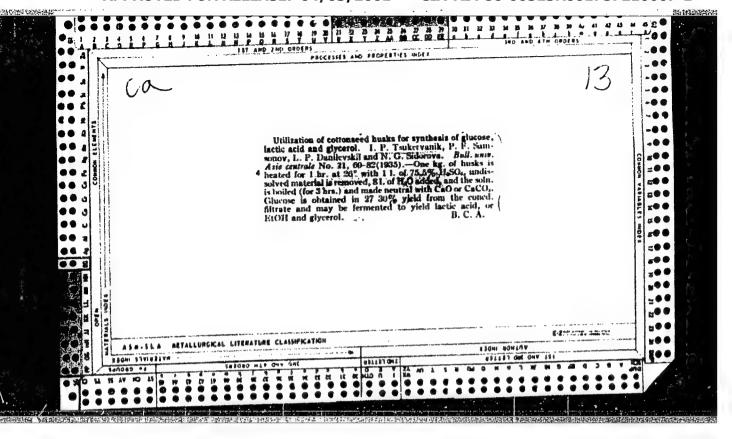
TSUKERSHTEYN, Ye.I., prof.; KARLINSKIY, V.M., kand.med.nauk

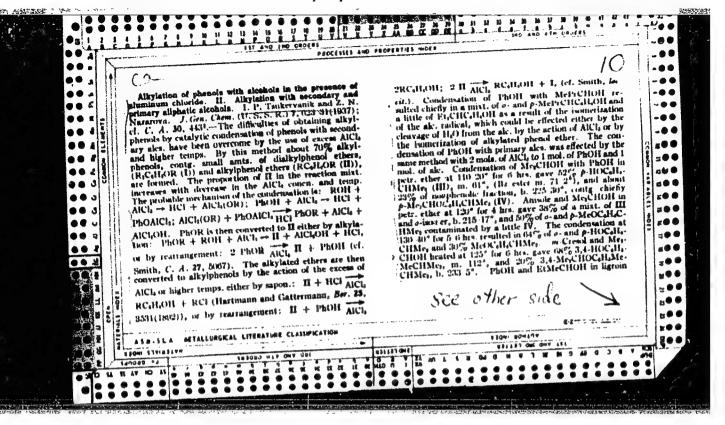
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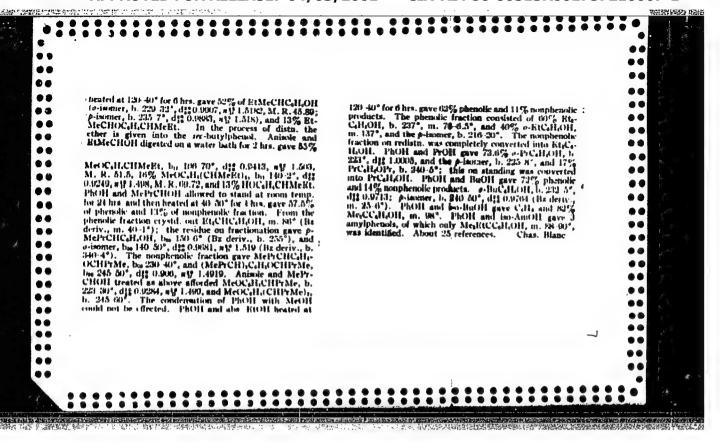
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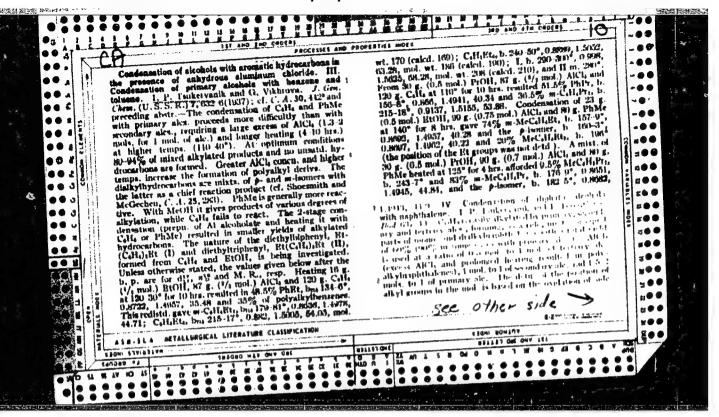


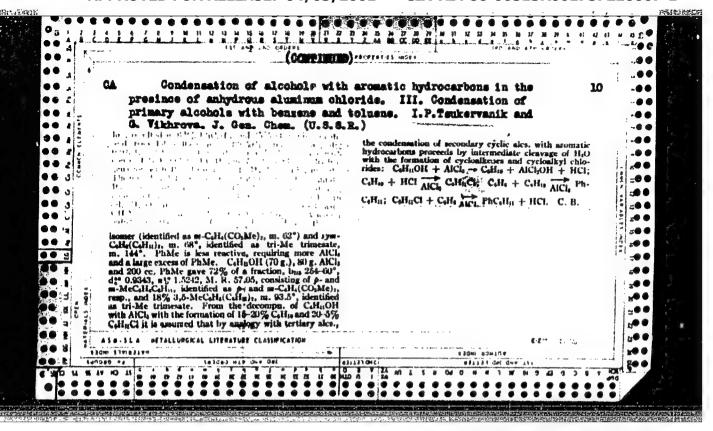


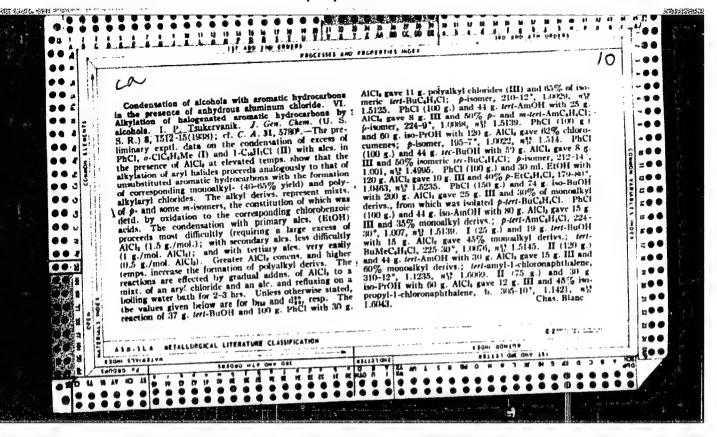


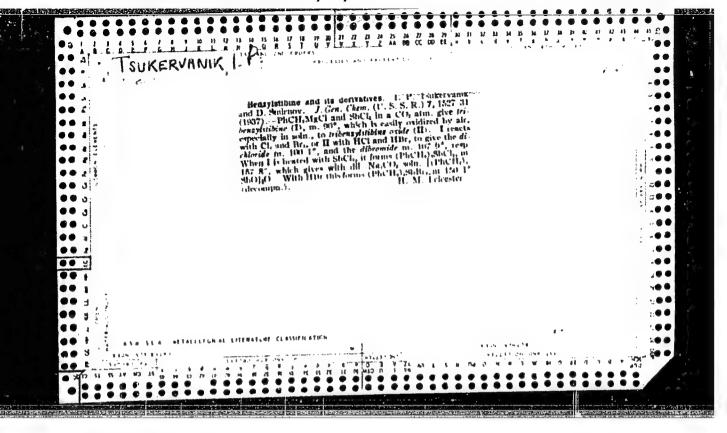


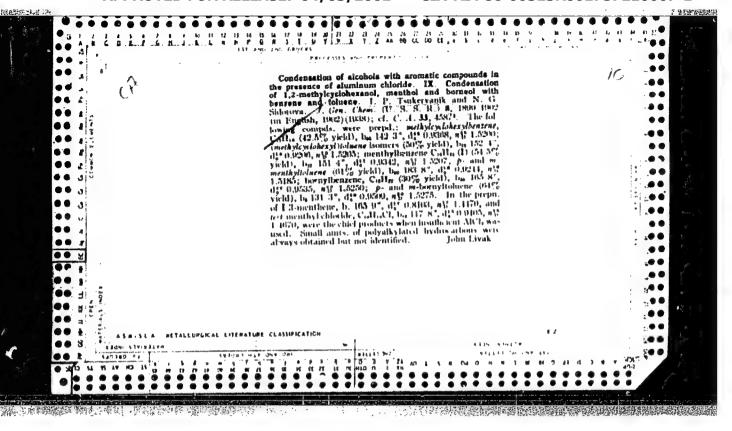


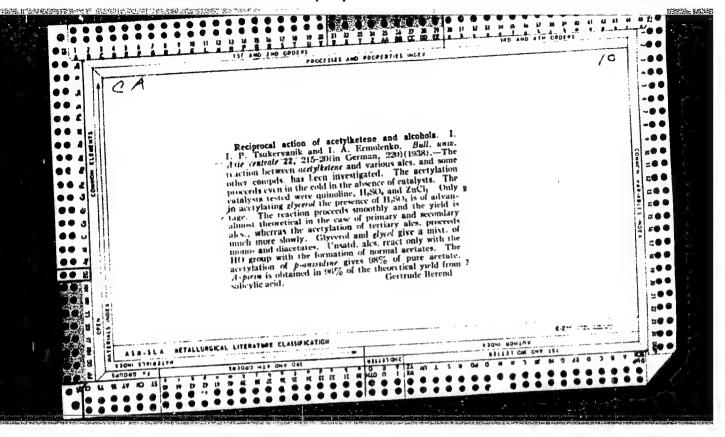


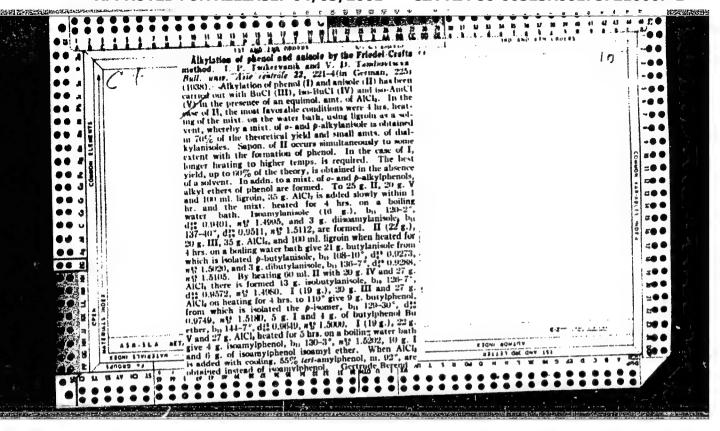


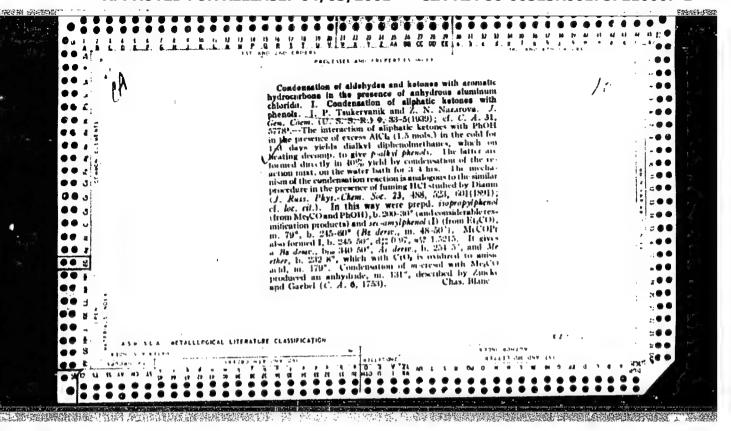


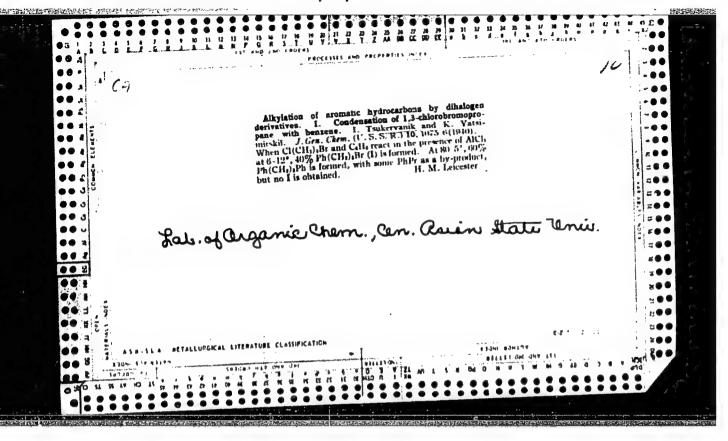


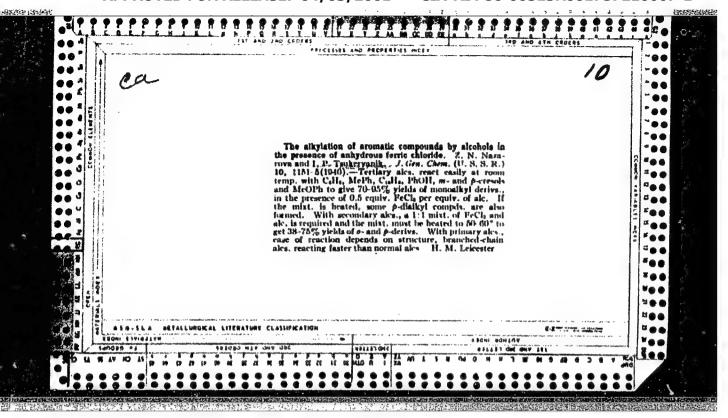


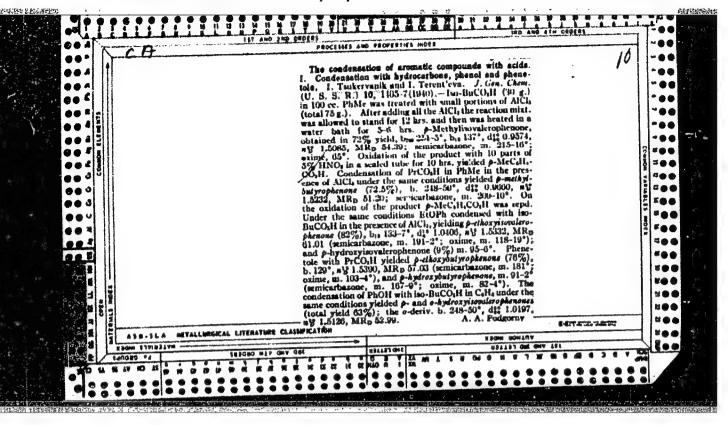


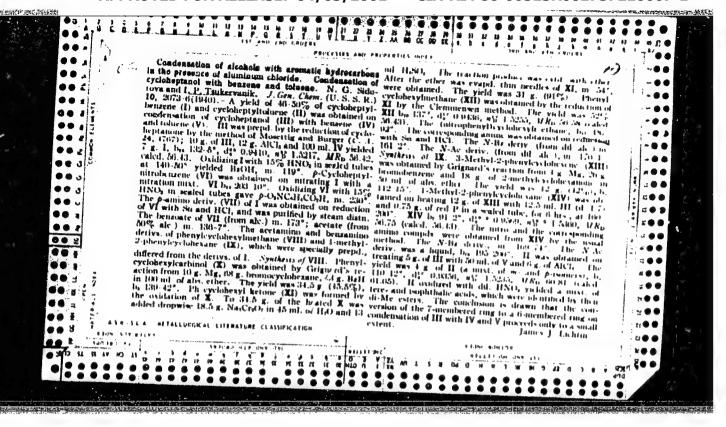


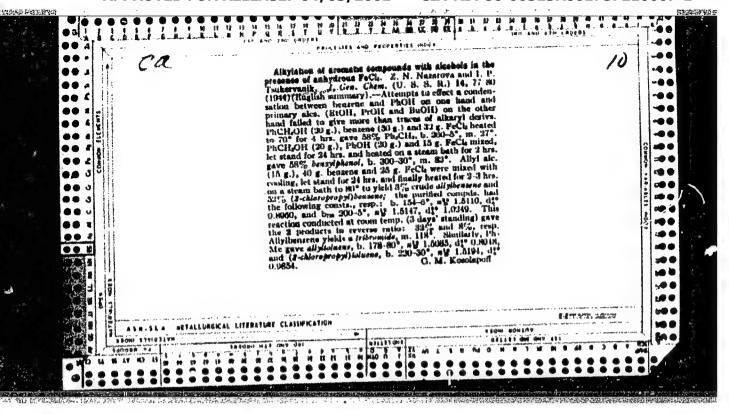


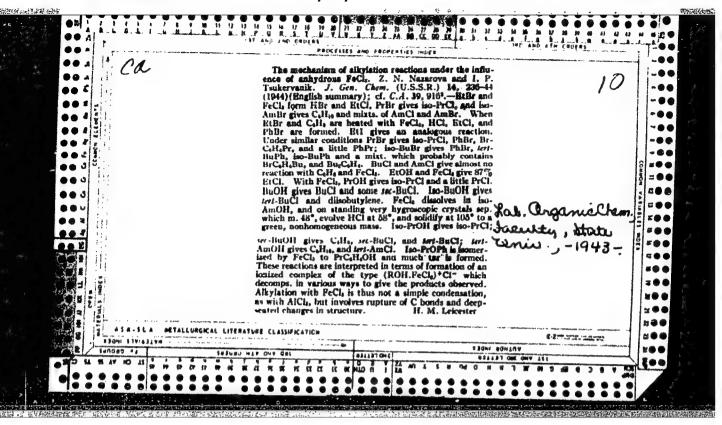


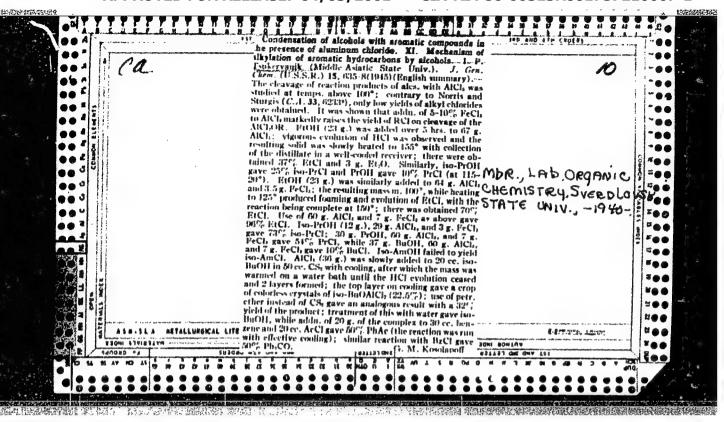


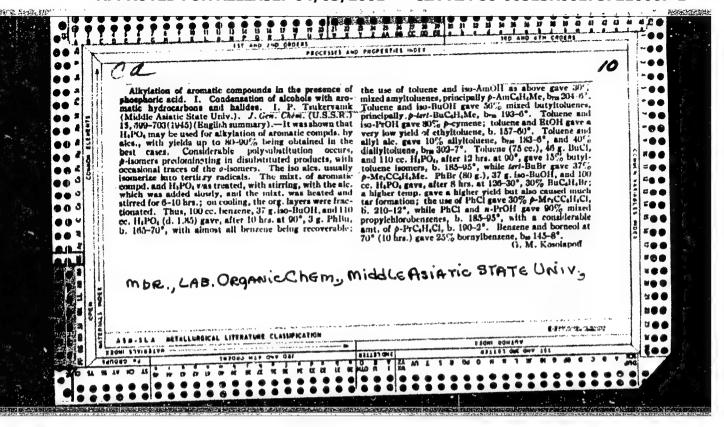


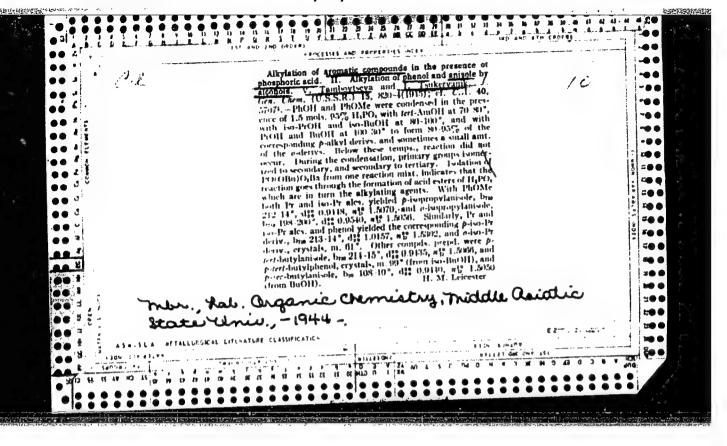


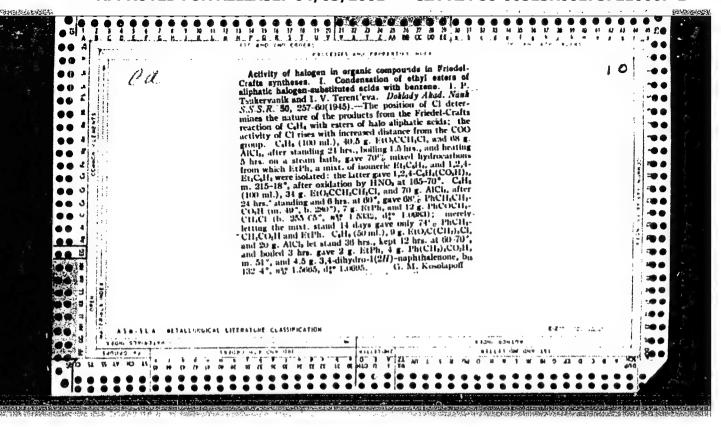


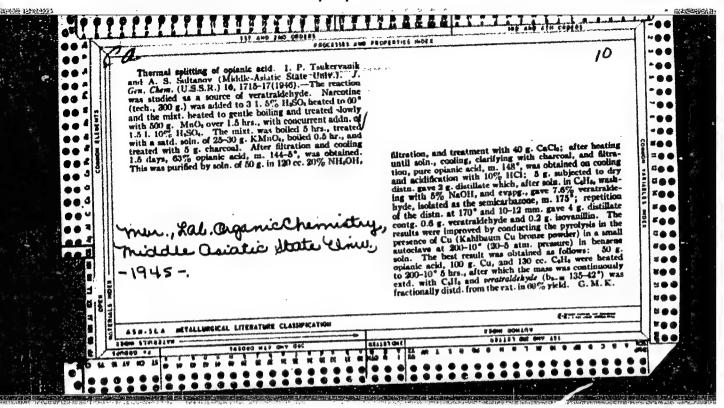












MEL'KANOVITSKAYA, S.G.; TSUKERVANIK, I.P.

Allylation of phenol compounds in the presence of a copper catalyst. Dokl.AN Uz.SSR no.11:40-44 '59.

(MIRA 13:4)

1. Institut khimii AN UzSSR. 2. Chlen-korr. AN UzSSR (for Tsykervanik).

(Propene) (Eugenol)

sov/79-28-8-7/66

: STANTS:

Mel'kanovitskeya, S. G., Tsukervanik, I. P.

TITIE:

Radical and Ionic Alkylation of the Aromatic Nucleus (Radikal'noye i ionnoye alkilirovaniye aromaticheskogo yadra) VII. Butylation of Benzene, Naphthelene, Thenol, and Anisole (VII. Butilirovaniye benzola, naftalina, fenola i

enizola)

MIRTODICAL:

Zhurnal obshchey khimii, 1958, Vol. 28, Nr 8, pp. 2032-2038 (USSR)

AB TRACT:

In connection with a previous paper (Ref 1) this paper ettempts to explain the peculiarity of the alkylation of different compounds with n-butyl chloride in the presence of copper. As an example the free radical butylation of anisola was investigated. n-Butylphenyltriazene was used as the gource of free butyl radicals. In contrast to the benzylation and the reaction with diphenylchloromethane the butylation with copper proceeds much more difficultly (at 200-250°). In reacting n-butylchloride with benzene, naphthalene, phenol, and anisole the corresponding monobutyl and dibutyl aromatic compounds resulted, and in the case of phenol a butyl ether

Card 1/3

Radical and Ionic Alkylation of the Aromatic Nucleus. SOV/79-28-8-7/66 VII. Butylation of Benzene, Maphthalene, Phenol and Anizole

of the butylphenol also resulted. Side products could not be determined. In every case it was the secondary butyl derivative which was produced. The proof of the structures was carried out by perbrominating and oxidizing. It was found that the alkylation product yield in the above reactions was 38-87 %. Thermal butylation also yielded alkyl derivatives. Under the experimental conditions used an isomerization of the primary butyl group to the secondary form always took place. The butylation of phenol follows the mechanism of indirect nuclear alkylation. Free butyl radicals produced by the thermal decomposition of n-butylphenyltriazene can be used to alkylate the anisole nucleus. There are 4 tables and 25 references, 11 of which are Soviet.

ASSOCIATION:

Institut khimii Akademii nauk UzSSR (Institute of Chemistry

AS UZSSR)

SUBMITTED:

July 12, 1957

Card 2/3

Redical and lonic Alkylation of the Aromatic Hucleus. Rev/79-28-8-7,66 VII. Bulylation of Benzene, Haphthalene, Phenol, and Anisole Card 3/3

TSUKERVENIK, I. P., Belinson, Z. Ya. SOV/79-28-8-8/66

TIPLE: Condensations of Benzotrichloride With Benzene in the Presence of Aluminum Chloride (Kondensatsii benzotrikhloride : of Aluminum Chloride (Kondensatsii benzotrikhloride : benzolom v prisutstvii khloristogo alyuminiya)

PERIODICAL: Zhurnal obshchey khimii, 1958, Vol. 28, Nr 8, pp. 2038-2042(USSE ARSTRACT: The authors investigated the condensations of benzotrichloride with benzene in order to produce the various substitutions with benzene in order to produce the various substitutions of the chloride atom and to ascertain the conditions under of the chloride atom and 9-phenylfluorene form. It was which triphenylmethane and 9-phenylfluorene form. It was found that the amount of AlCl3 present is a definite factor

in this synthesis. Using 0,1 mole AlCl, (to 1 mole benzotrichloride), and independent of the temperature (15-90°) and the reagent concentration, a yield of 70% diphenyldichloromethane was obtained with a small side product of triphenylmethane was obtained with a small side product of triphenylmethane. With 1 mole of AlCl, triphenylchloromethane chloromethane. With 1 mole of AlCl, triphenylchloromethane was produced as the main product with a yield of 80-98 %. Was produced as the main product with a yield of an ardening Further increases in the amount of AlCl, caused a hardening

reaction and a decrease in the triphenylchloromethane yield. Other factors in this synthesis were studied, among them

Card 1/2